

Remarks

Status of the claims

Claims 1, 2, and 4-7 are pending in the application. Claims 4-7 are withdrawn from consideration. Claim 1 has been amended herein. Support for the amendments in claim 1 can be found in claim 3 as originally filed as well as the specification at, *inter alia*, page 15, lines 16-27, the examples, and Table 1. Claim 3 has been cancelled herein. No new matter has been added.

Issues under 35 U.S.C. § 112, second paragraph

In the outstanding Office Action, the Examiner rejected claim 2 under 35 U.S.C. § 112, second paragraph, as being indefinite. However, based on the statements made by the Examiner, Applicants believe the rejection actually applies to claim 3. Claim 3 has been cancelled herein, but its limitations are now recited in claim 1.

Specifically, the Examiner asserts that the term “ppm” is not a conventional way to describe the size distribution of a powder. Claim 1 has been amended to further clarify the present invention. In particular, it is apparent from the measuring method of content of aggregated particles specified in the example of the present specification that the “ppm” indicates “weight ratio” but not quantity ratio of particles. In other words, as the dried silica remaining on the sieve is measured to find the content, the content is expressed in the form of “weight ratio.” This is clear to those of skill in the art.

However, Applicants respectfully submit that the language has been clarified to state “weight ratio.” Thus, this rejection is moot.

Issue under 35 U.S.C. § 103(a)

Claim 1-3 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Konya et al. (US 2003/0103890). Claim 3 has been cancelled herein, which renders the rejection as to this claim moot. Applicants respectfully assert that Konya et al. do not disclose each and every element of, at least, independent claim 1. Thus, Applicants respectfully traverse, and reconsideration and withdrawal of this rejection are respectfully requested.

The Examiner asserts that the hydrophobic fumed silica of the present invention specifies merely physical properties of a hydrophobic fumed silica produced through the surface treating method of Konya et al. However, Applicants respectfully submit that the hydrophobic silica of the present invention is entirely different from the hydrophobic silica of Konya et al.

The Present Invention and Its Advantages

It is known to impart hydrophobic properties to a siloxane compound, such as cyclic dimethylsiloxane or the like, to increase the dispersion property in resin matrix of fumed silica. Thus, hydrophobic property-imparted fumed silica is increased in its bulk density by mechanical pulverization, such as ball mill grinding or the like. An increase in bulk density is carried out to prevent the scattering of dust and to provide better handling properties for packaging or dispersing in matrix.

However, improvement in the dispersion property is further required since the dispersion property of prior art hydrophobic silica is insufficient. In addition, due to the higher content of large aggregated particles, the kneading property into resin or the like is poor, which requires a long kneading time.

In stark contrast, the present invention is a hydrophobic fumed silica having high tapping bulk density (e.g., “a tapping bulk density of larger than 80g/L but not larger than 130 g/L”) and superior dispersion property (e.g., “an n-value representing the dispersion of 3.0 to 3.5 as measured in toluene”) into a matrix such as a resin. Moreover, the present invention contains very few large aggregated particles (e.g., “a content of aggregated particles of not smaller than 45 μm is not larger than 200 ppm in weight ratio”). This hydrophobic fumed silica is produced by (A) conducting a compacting treatment so that the tapping bulk density of the fumed silica becomes 70 to 120 g/L prior to the hydrophobic property-imparting process for the fumed silica and (B) treating the hydrophobic property-imparting process by bringing the compacted fumed silica into a gaseous cyclic dimethylsiloxane which is supplied after conducting the compacting treatment.

In this production method, the compacting treatment increases the bulk density using a vacuum compressor without giving any shearing force as in a mechanical pulverization such as a ball mill grind.

The hydrophobic fumed silica of the present invention, as described in amended claim 1, has the following mechanical properties:

- (a) "an M-value representing an oleophilic degree in a range of 48 to 65."
- (b) "a tapping bulk density of larger than 80 g/L but not larger than 130 g/L."
- (c) "an n-value representing the dispersion of 3.0 to 3.5 as measured in toluene."
- (d) "a content of aggregated particles of not smaller than 45 μm is not larger than 200 ppm in weight ratio."

As recited, the hydrophobic fumed silica of the present invention demonstrates excellent dispersion property into a matrix such as a resin. Furthermore, the present invention is also expected to exhibit less dust scattering and easier handling properties due to the tapping bulk density within the claimed range. Moreover, better kneading properties in matrix as well as swift and even dispersion are favorably anticipated due to the remarkably fewer content of aggregated particles of not less than 45 μm .

Applicants respectfully submit that any known hydrophobic fumed silica of which bulk density is increased by mechanical pulverization, such as ball mill grinding, cannot demonstrate such excellent properties. For example, a silica having high bulk density and high hydrophobic property is well known, but such hydrophobic silica shows lower dispersion property in a matrix such as a resin due to lower n-values in toluene and also lower kneading properties due to the high content of rougher aggregated particles.

Under common technical knowledge, when conducting treatments both for increasing bulk density and for imparting hydrophobic properties, the treatment for increasing bulk density is conducted after the hydrophobic property-imparting treatment is done. The method of the present invention of carrying out the hydrophobic property-imparting treatment after the treatment for increasing bulk density has not been practiced so far. Typically, once bulk density is increased, particles are heavily gathered, which makes both a reaction with the siloxane compound difficult and the hydrophobic property-imparting insufficient. However, the present

invention increases bulk density by a compacting treatment not accompanied by a shearing force. Moreover, after such compacting treatment, the hydrophobic property-imparting treatment is carried out by supplying a gaseous cyclic dimethylsiloxane. Thus, it was heretofore unknown that the hydrophobic property-imparting treatment could be efficiently carried out to produce hydrophobic fumed silica having said properties even after bulk density is increased.

The fumed silica of increased bulk density (fumed silica having a tapping bulk density in a range of 70 to 120 g/L) to be supplied for hydrophobic property-imparting treatment keeps moderate space between particles while the bulk density is increased by the compacting treatment. As the hydrophobic property-imparting treatment is carried out by supplying gaseous cyclic dimethylsiloxane, the cyclic dimethylsiloxane is widely spread in the space between the particles, and the hydrophobic property-imparting treatment is conducted efficiently and evenly. As a result, the hydrophobic fumed silica, as recited in claim 1, has superior dispersion properties into resin or the like and has few large aggregated particles (e.g., "a content of aggregated particles of not smaller than 45 μm is not larger than 200 ppm in weight ratio").

For example, when the bulk density is increased by ball mill grind rather than a compacting treatment prior to hydrophobic property-imparting treatment, the dispersion becomes poor (n-value of toluene becomes low) and a number of large aggregated particles are formed. In other words, when mechanical pulverization accompanying shearing force is applied, efficient hydrophobic property-imparting treatment cannot be carried out even if gaseous cyclic dimethylsiloxane is employed because the particles combine tightly to each other and a number of aggregated particles are formed as well.

The hydrophobic fumed silica of the present invention having the properties as recited in claim 1 cannot be obtained when carried out by hydrophobic property-imparting treatment prior to a compacting treatment by cyclic dimethylsiloxane. In this case, hydrophobic fumed silica having good dispersion properties and few large aggregated particles can be produced, but since an increase of bulk density could not be achieved by a compacting treatment, tapping bulk density is considerably lower than 80 g/L. Thus, the prevention of dust scattering and the handling properties are lowered.

In sum, the hydrophobic fumed silica of the amended claim 1 is novel and nonobvious.

Distinctions Over the Cited Art

The hydrophobic fumed silica disclosed in Konya et al. is produced by means that the hydrophobic silica fine powder (fumed silica) is first imparted with hydrophobic properties while compacting by ball mill. Then, the silica is further imparted by reacting it with ammonia or amine. The fumed silica of Konya et al. has a bulk density in the range of 100 to 300 g/L.

Thus, Konya et al. disclose a hydrophobic-property imparting treatment by cyclic siloxane and a bulk density range of 100 to 300 g/L. Regarding treatment with cyclic dimethylsiloxane, the Examiner states that Konya et al. teaches the use of a cyclic siloxane as a hydrophobizing agent. Since dimethylsiloxane is a simply cyclic siloxane, the Examiner contends it is an obvious choice. As the Examiner admits, Konya et al. do not describe n-values in toluene. However, the Examiner alleges that a high n-value is inherent in products produced in Konya et al. Therefore, the Examiner asserts that the hydrophobic fumed silica of the present invention is obvious over Konya et al. Applicants respectfully traverse.

The Examiner asserts that the bulk density range of Konya et al. overlaps the bulk density range of the present invention, citing the abstract of Konya et al. The abstract of Konya et al. states, "The powder has an *aerated* bulk density of 100-300g/l..." (emphasis added). As described in paragraphs [0027]-[0029], the "aerated bulk density" is measured without tapping treatment and differs from the tapping bulk density. The "aerated bulk density" is calculated after measuring the weight of the cell without tapping treatment where 100 mL of sample powder is dropped through a vibrating sieve. Therefore, the value of "aerated bulk density" tends to be rather lower than that of tapping bulk density. Thus, the tapping bulk density of hydrophobic fumed silica of Konya et al. is not less than 130 g/L since the aerated bulk density is 100 to 300 g/L.

The compacting treatment in Konya et al. is conducted by ball mill grinding accompanying mechanical shearing force. In addition, the compacting treatment is not carried out prior to the hydrophobic property-imparting treatment. Thus, the method of making the silica of Konya et al. is entirely different from the method described in the instant specification of the present invention when hydrophobic property-imparting treatment is carried out after

compacting treatment. There would thus be no expectation that the silica produced would be similar. In other words, the hydrophobic fumed silica of Konya et al., which is produced by compacting treatment accompanying mechanical shearing force such as a ball mill, cannot provide the properties recited in claim 1 of the present invention.

In the instant specification, a compacting treatment by ball mill is conducted in Comparative Examples 4 and 5. The content of the aggregated particles of not less than 45 μm is far over 200 ppm, the dispersion into resin is poor, and the n-value in toluene is lower than that of hydrophobic fumed silica of the present invention.

On the other hand, the hydrophobic property-imparting treatment in the present invention is carried out by means to bring gaseous cyclic dimethylsiloxane into contact with the fumed silica to efficiently impart hydrophobic properties after the compacting treatment. In contrast, Konya et al. disclose the use of liquid siloxane rather than gaseous siloxane.

The hydrophobic fumed silica of the present invention is described above. As the hydrophobic fumed silica of Konya et al. is produced by an entirely different method, its properties, especially tapping bulk density, are clearly different from that of the present invention and would not be expected to be the same as the present invention.

To establish a *prima facie* case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (See MPEP 2143.03). As discussed above, Konya et al. fail to teach or suggest all the claim limitations of independent claim 1, and claim 2 dependent thereon. Therefore, a *prima facie* case of obviousness has not been established, and withdrawal of the instant rejection is respectfully requested.

For the reasons given above, Applicants therefore respectfully submit that claims 1-2 clearly distinguish over the cited prior art.

As the above amendments and remarks address and overcome the rejections, withdrawal thereof and allowance of the claims are respectfully requested.

Conclusion


In view of the above remarks, it is believed that claims are allowable.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Marc S. Weiner, Reg. No. 32,181, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

By  #42.874
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